January 29, 2002

**<u>Ex Parte Letter</u>**

Mr. William Caton
Acting Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Twelfth Street Lobby, TW-A325
Washington, D.C. 20554

***Re: IB Docket No. 01-185, IB Docket No. 99-81, ET Docket No. 95-18***

Dear Mr. Caton:

On January 24, 2002, on behalf of ICO Global Communications (Holdings) Ltd. ("ICO"), Gerry Salemme, Larry Williams, Paul Regulinski, ICO Counsel Cheryl A. Tritt and the undersigned met with IB Associate Bureau Chief for Policy Jim Ball, Deputy Chief of the Planning and Negotiations Division Breck Blalock, Chief of the Planning and Negotiations Division Richard Engelman, Satellite Policy Branch Chief Ronald Repasi, David Krech of IB, Paul Locke of IB, Howard Griboff of IB, Gary Thayer of OET, and Nese Guendelsberger of WTB. During the course of the meeting, ICO briefed the staff on the technical aspects of ICO's proposed ancillary terrestrial component for mobile satellite service providers ("MSS"). ICO also responded to interference issues raised by commenters in the above-captioned proceeding.

In accordance with Section 1.1206(b) of the Commission's rules, I am submitting an electronic copy of this letter. If you have any questions concerning this matter, please do not hesitate to contact me.

Very truly yours,

<u>/s/ Suzanne Hutchings</u>
Suzanne Hutchings
Senior Regulatory Counsel
ICO Global Communications (Holdings) Ltd.

cc: Jim Ball
Breck Blalock
Richard Engelman
Nese Guendelsberger
David Krech
Paul Locke
Howard Griboff
Ronald Repasi
Gary Thayer

# ICO Technical Briefing to FCC SC / ATC Topics

January 2002

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# Discussion Topics

- Product and Service approach
- Integrated Operations & Seamless Services
- SC / ATC Spectrum
  - how managed and controlled
  - Out Of Band emissions



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# ICO Products and Services
## Services Elements & UE description

**SERVICE ELEMENTS**

- Voice
- Fax
- Access to web based ISP e-mail
- Cache updates
- VPN access
- Web access
- Messaging
- Location reporting
- Voice group call
- Large file transfer
- Dial up networking

**USER TERMINALS**

- UE - Service Elements mapping
- Personal accessory concept
- Vertical UEs Repeater concept
  - Maritime
  - Aeronautical
  - Land portable [ICO Mobile Office]
  - Transportation
- Dual mode handheld



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# ICO Products and Services

- ICO intends to develop a variety of horizontal market and vertical market user products.
- Products involve a number of integrated packaging, service, and usage scenarios.
- Primary market research and related business plan will lead to product and service selections.
- It is critical that ATC usage rules not dictate form, packaging, or usage scenarios. Flexibility is critical to success; in meeting evolving consumer needs, and in developing successful offerings.



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# Integrated Operations & Seamless Service

Integrated Operations & Seamless Service



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# Why is an integrated SC/ATC preferable to conventional dual-mode operations?

***Alignment of interest***:

- One business entity (network operator) operates both SC and ATC, ensures alignment of business goals and *equitable treatment* of users of SC and ATC components alike
- No conflict of interest between providing service to visiting vs. home subscribers

***Integrated Customer Care***:

- The customer is always at “home” i.e. served by the home network operator, regardless of current radio access (i.e. ATC or SC) or location
- The Customer is not simply a foreign visitor from another network
- No problems with access to Customer Care from multiple visited networks



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# Why is an integrated SC/ATC preferable to conventional dual-mode operations?

***Improved Coverage***:

- Multiple radio access networks, each suited to *different* environments
- SC for sparsely populated regions e.g rural, maritime
- ATC for densely populated region e.g urban canyons

***Transparent Service Delivery***:

- Common service delivery platform for both ATC and SC components
- Common "look and feel" regardless of radio access or geographic location
- Telephony Services (basic (voice, fax SMS), supplementary (call forwarding, multi-party), and value added (voice mail, fax mail)), and data services, all will benefit from integrated and transparent service delivery.



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# SC / ATC Spectrum

- how managed and controlled
  - focus on Dynamic Resource Management
- OOB emissions



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# SC / ATC Spectrum - management and control

## Dynamic Resource Management



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# Overview

- An MSS operator with an **integrated** satellite component (SC) and ancillary terrestrial component (ATC) would have the ability to **dynamically manage spectrum resources between SC and ATC**. It is essential to exploit this advantage in order to achieve the most efficient use of the available MSS spectrum.

- ICO has already developed, built and installed a sophisticated Satellite Resource Management System (SRMS), which has the capability to manage spectrum dynamically and efficiently for its satellite system.

- This presentation provides an overview of the current SRMS and how it can be extended to include management of an integrated ATC.




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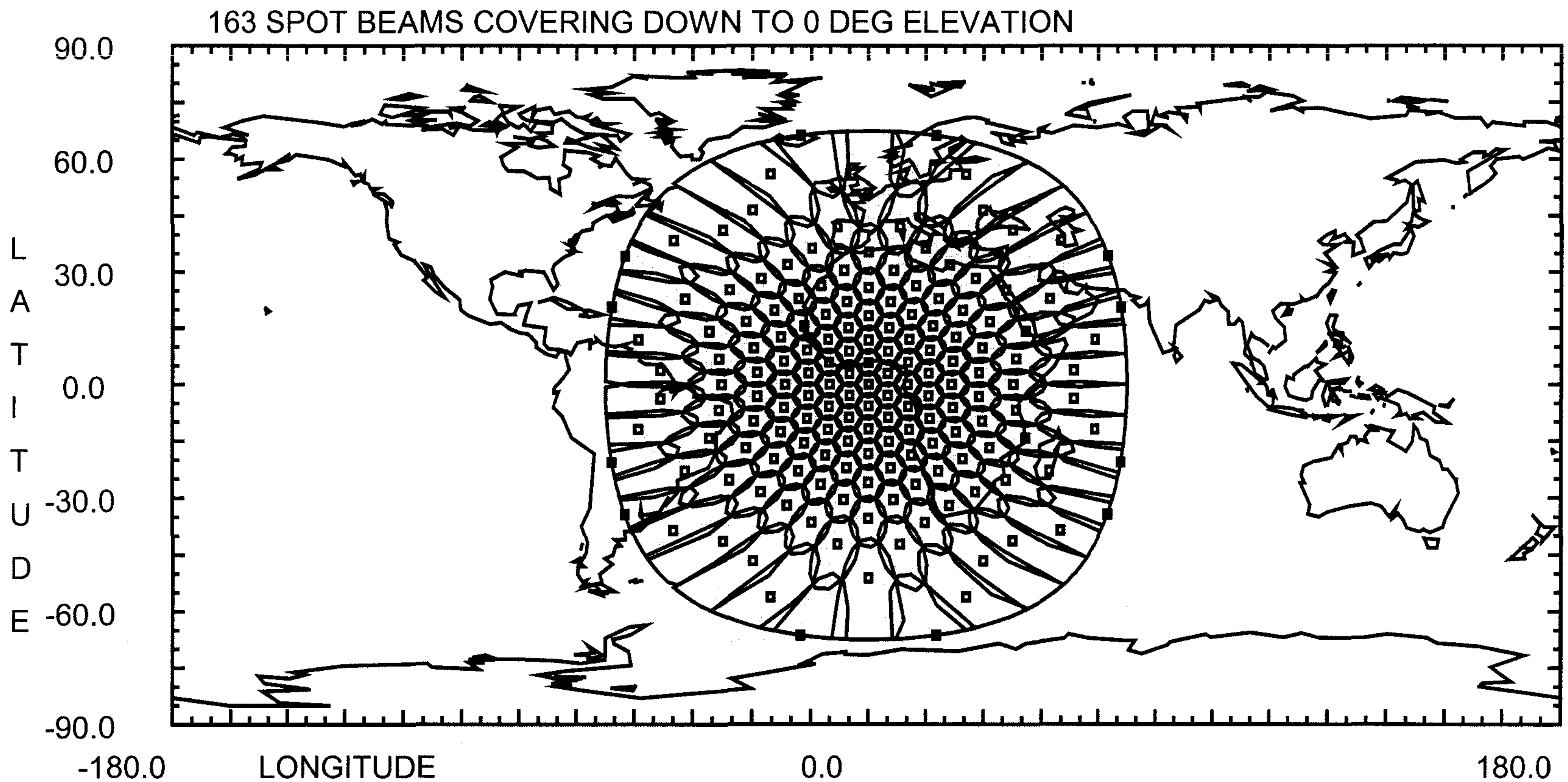
# Typical Coverage Footprint

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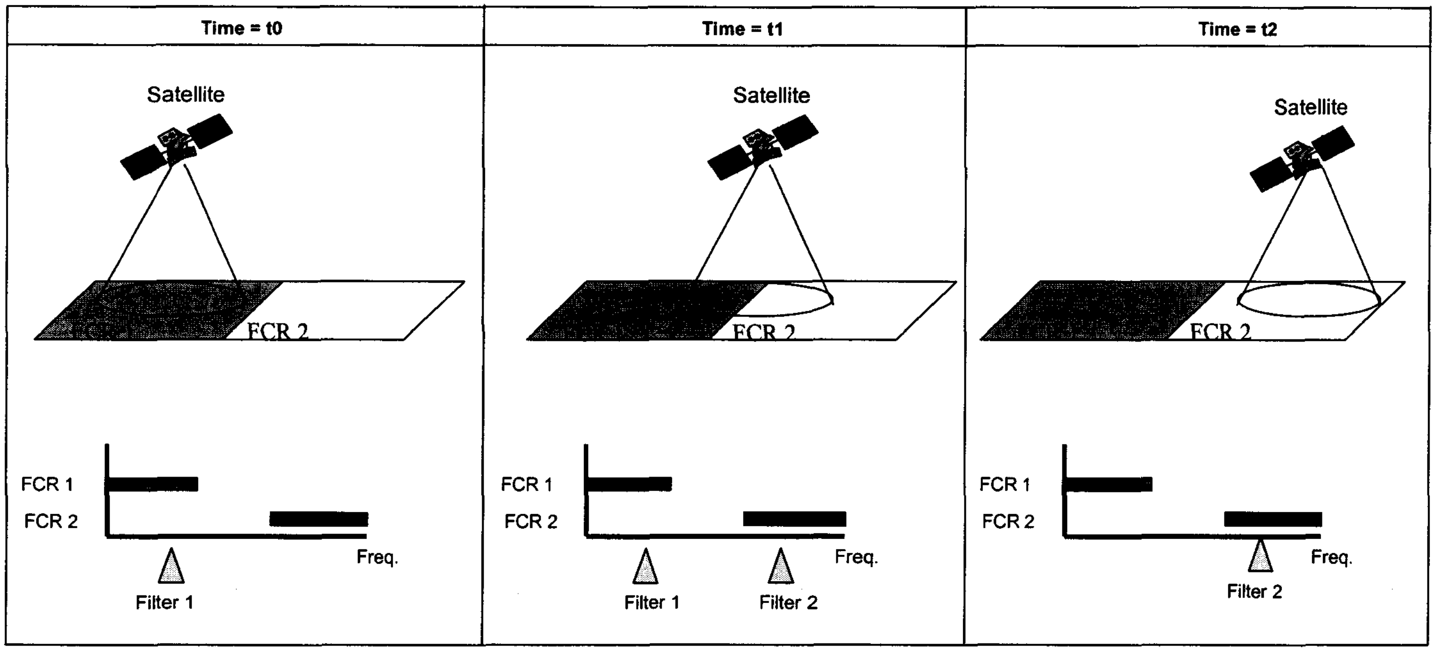
# Dynamic Nature of the ICO SRMS

The ICO SC component requires **<u>Dynamic Frequency Planning</u>** to manage:

- Coverage moving (at about 1° per minute) with respect to the surface of the Earth and covering different FCRs[1] at different time.
- Spotbeam coverage being in view of different traffic density areas on the ground.at different times.



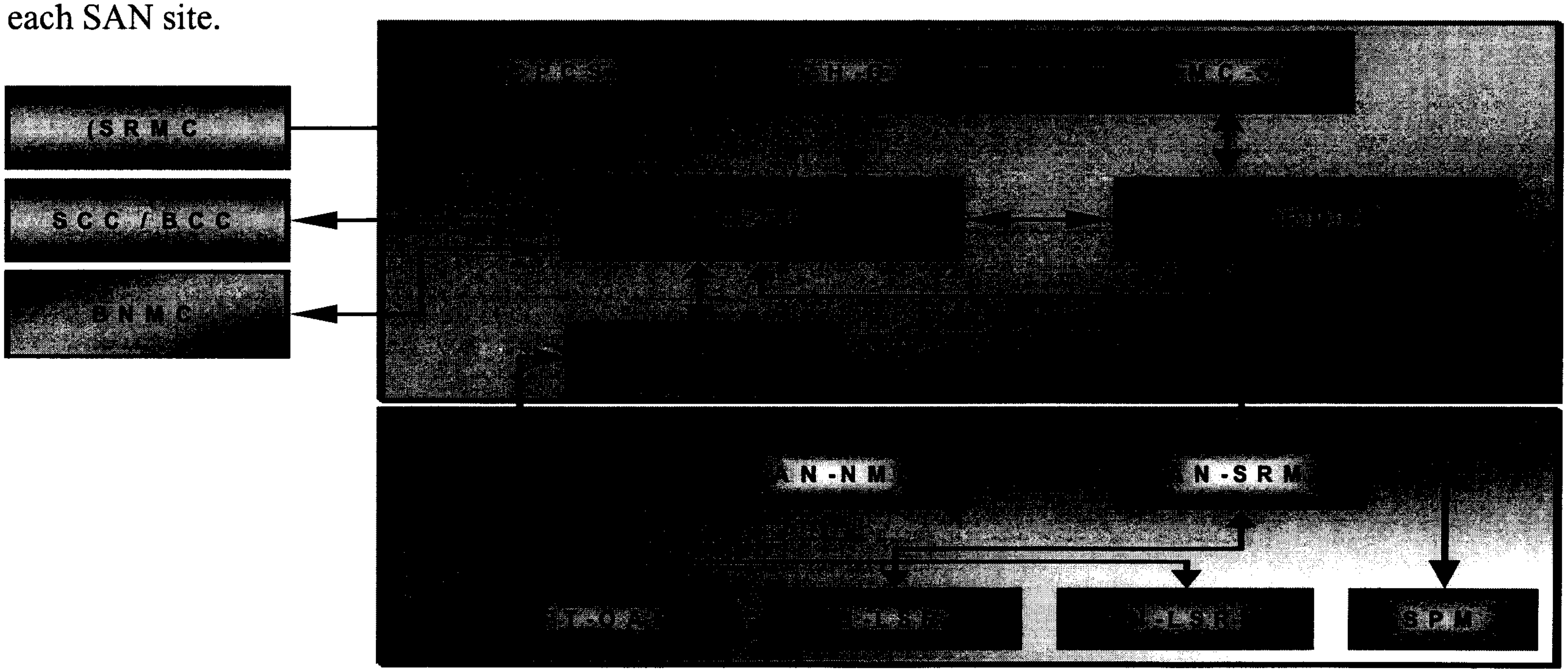

[1]A Frequency Co-ordination Region (FCR) is a contiguous geo-graphical region where a particular frequency or set of frequencies is available for communications..

# SRMS Interfaces

The SRMS consists of a central Satellite Resource Management Center (SRMC), which generates plans to configure all of the satellites and Satellite Access Nodes (SANs).

Distribution of the plans to the satellites is performed by the Payload Command System (PCS).

Distribution of the plans to the SANs is performed by a central server (Link-Satellite Resource Handler) and distributed servers (Satellite Access Node-Satellite Resource Management Systems -SAN-SRMS) at each SAN site.



# Key SRMS Functions

- Global coverage planning;
  This function determines for each timestep, which combination of satellite and SAN can provide the best coverage to each geographic region.
- Global traffic planning;
  This function processes data on previously carried traffic and forecasts the traffic demand for each spotbeam as a function of time.
- Frequency planning;
  This function determines which frequencies are assigned to each spotbeam as a function of time, so as to carry as much traffic as possible, while meeting various system and interference constraints.
- Power planning;
  This function adjusts the resource plans so that the satellite and SAN power limitations are not violated.
- External interference management
  This function permits the configuration of which frequencies are available and not available for each geographic region and each spotbeam.



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# Inputs into SRMS

The SRMS produces time-varying resource plans based on a 1x1-degree grid of the global ground cells,
taking as input the following system constraints:

- The global frequency allocations for each ground cell;
- 4 cell frequency re-use patterns;
- Satellite field-of-view and self-interference constraints;
- Interference constraints of other services operating in 2 GHz
- Interference and spectrum coordination agreements with other MSS operators
- Instantaneous available frequency;
- Traffic demands;
- Moving satellites/beams;
- Overlapping satellite beams; and
- The limited satellite power and available filters per satellite

 

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# Resource Plan distribution

The main outputs of the SRMS are the following time-variant resource plans :

- Burst Time Frequency Plans (BTFP);

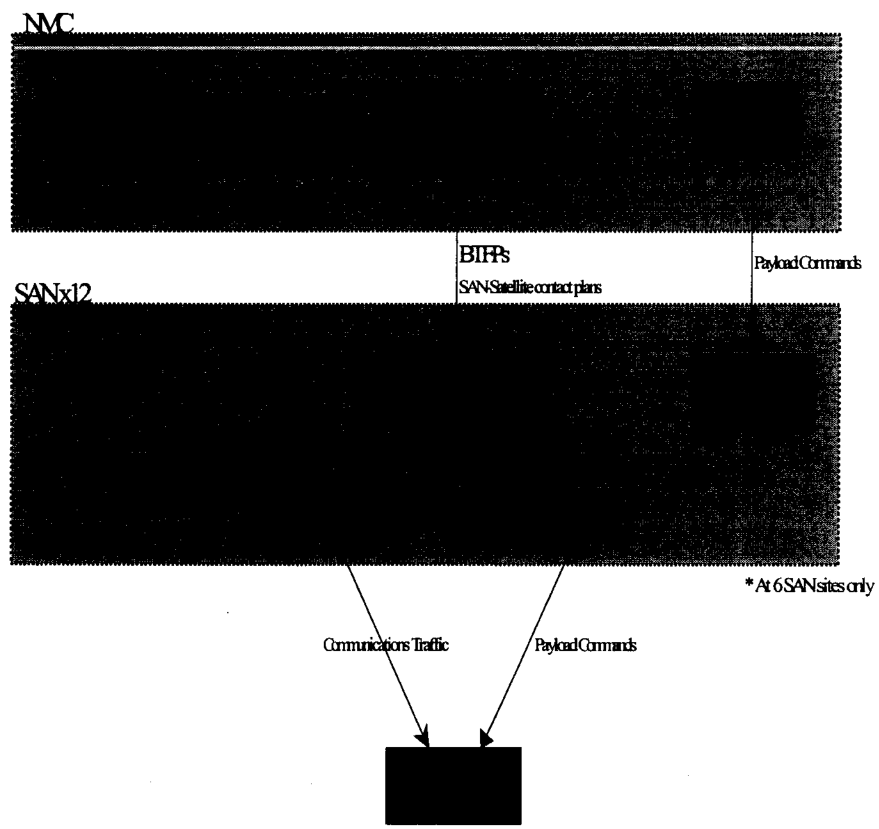
  BTFP are the resource plans used by each SAN. They define for each time-step a pool of frequencies and TDMA timeslots that are available in each spotbeam of each satellite in contact with that SAN.

- Satellite Channelization Plans (SCP);

  The SCPs define for each time-step for each of satellite the filter and frequency assignment for each spotbeam.

- SAN-satellite contact plans.

  SAN-satellite contact plans define which satellites are in contact with which SAN as a function of time.



# SRMS Conclusion

- ICO has already realized a system that dynamically and efficiently allocates spectrum resources within a satellite system.

- The next step is to extend these capabilities to have a dynamic resource management system for an integrated SC/ATC network.



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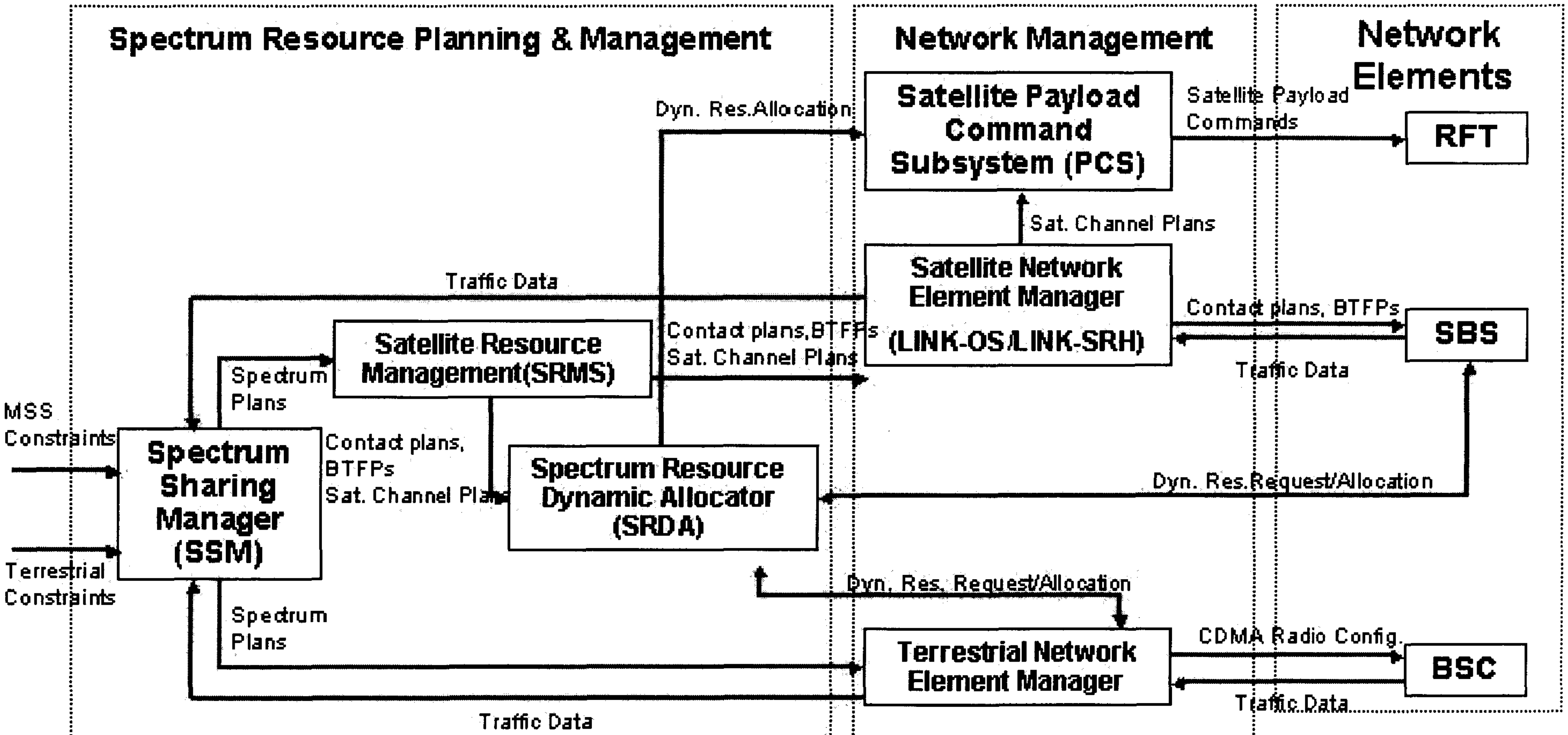
# Adding an ATC to the Resource Management System

- A Dynamic Resource Management System (DRMS) would shift frequencies between the SC and ATC according to traffic demands.



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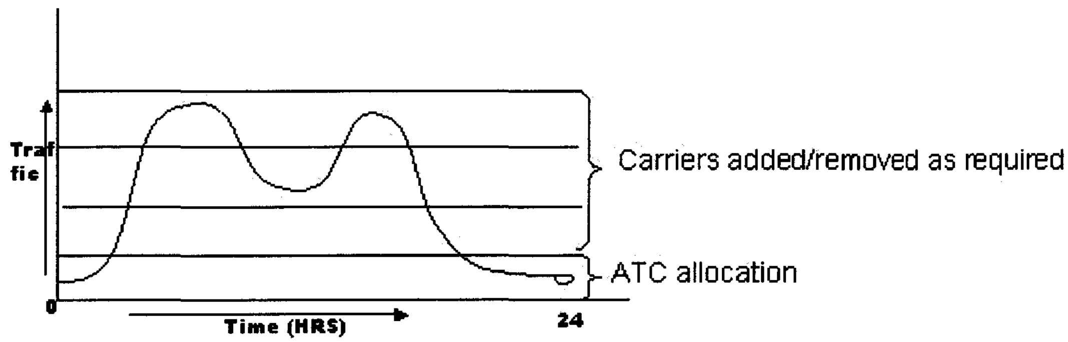
# Resource Management System Components and Functions

- At a high level, a Spectrum Sharing Manager (SSM) takes as input the traffic demands and resource planning constraints for both the SC and ATC parts of the system.
- SSM determines the time-varying spectrum requirements of the SC/ATC system.
- Dynamic resource plans are prepared and distributed to configure the SC and ATC parts of the system.
- At a lower level, a Spectrum Resource Dynamic Allocator (SRDA) would manage the dynamic sharing of spectrum between the ATC and SC components.
- The integrated dynamic resource management system would take into account each system's current use, ongoing demand, interference thresholds and other constraints to shift frequencies between the two resources - without interference and without needless, spectrum-inefficient hard band segmentation.

# Potential Traffic Management Methods for DRMS

- Admission Control - SC and ATC monitor SC interference thresholds. When the interference threshold is reached the SRDA is alerted, which then either assigns non-shared spectrum to new ATC calls or blocks new ATC calls.

- Carrier ON/OFF
  - when the traffic requirement increases, the base stations are allowed to turn more carriers ON as available from the shared pool.
  - Conversely, when the requirement decreases, the carrier is turned off, and the resource returned.



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# Conclusion

- ICO has already developed and installed an SRMS to operate its global NGSO MSS system.

- The same concepts ICO used to develop its SRMS apply to developing an extension of SRMS to manage ATC resources and SC/ATC resources.

- The key element to making SC/ATC work successfully is a totally integrated SC/ATC resource management system.

# OOB Emissions - Discussion Topics

- NPRM Comments
- ICO Approach
- Summary of ICO analysis
- OOB emission Budgets
- Guard Band Descriptions
- Proposed OOB Emission limits
- Proposed limits for other sharing modes



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# NPRM Comments - OOB Interference

- Comments from many parties support the concept of Spectrum Flexibility as requested by ICO
- Concern expressed that this additional flexibility should not undermine the capability of other MSS networks to operate normally in the MSS band
- Analysis material for all the sharing modes provided.



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# ATC Emissions

- ICO has determined that the following eliminates the potential for interference between an ATC component and the SC component of any other MSS system.
  - Provision of sufficient guard bands between the Adjacent MSS block and ATC
  - Hardware modifications of ATC components to reduce Out of Band emissions.
    - Additional IF & RF filtering
    - Use of sufficiently linear amplifiers
    - Improved local oscillators and LO filters
- ICO has shown in the NPRM reply comments that the proposed improvements will eliminate any significant interference to other MSS systems.

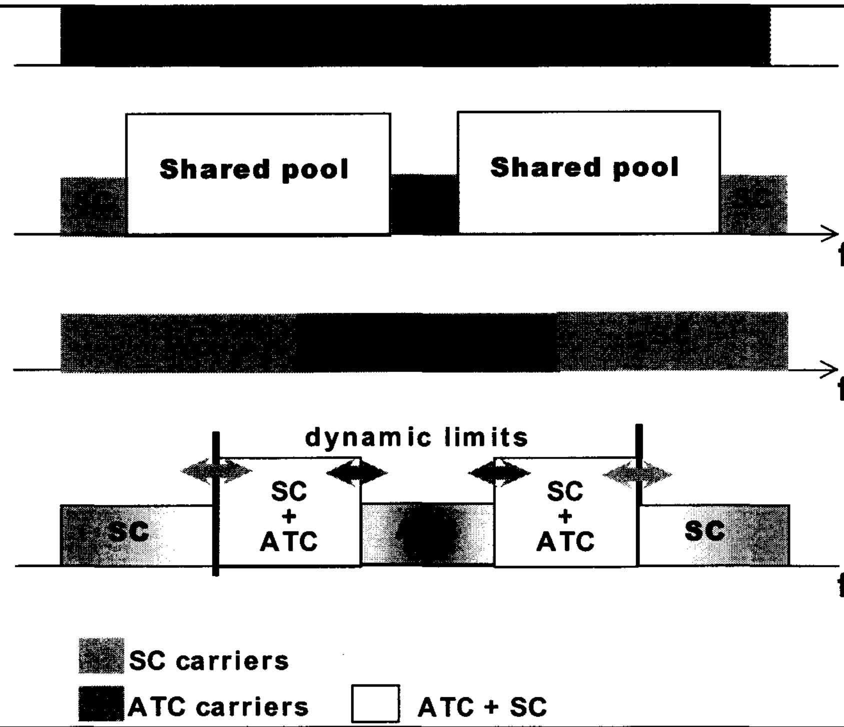
# Spectrum sharing between ATC and SC

- Sharing plan allows maximum amount of shared spectrum
  - dedicated spectrum used for signalling
  - SC dedicated spectrum sections act as "guard-bands"

**1) Ideal sharing scenario:**
- small number of carriers reserved for SC and ATC signalling
- Majority of carriers are shared

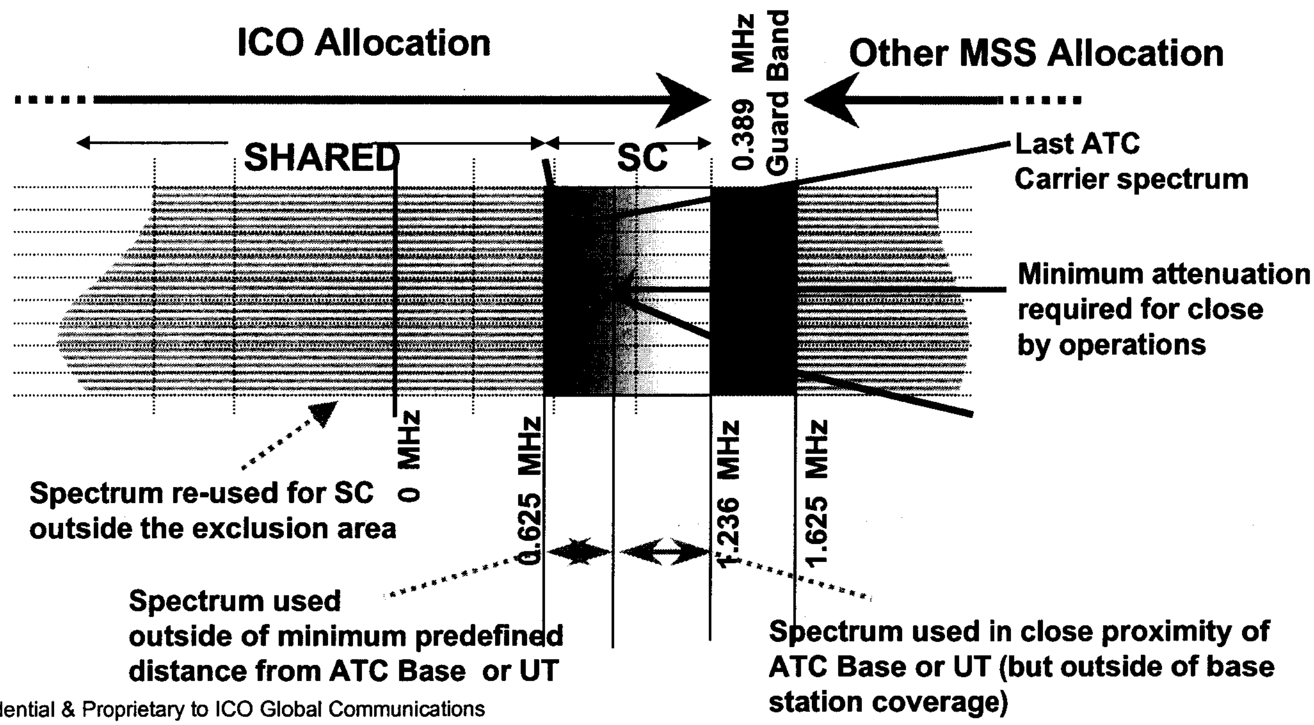
**2) Undesirable non sharing scenario:**
- Capacity is not optimized
- Partitioned MSS spectrum

**3) Typical dynamic sharing scenario:**
- Small number of carriers reserved for SC and ATC signalling
- Variable number of carriers reserved for SC traffic
- Variable number of shared carriers



# Spectrum Usage by SC

- Shared spectrum will be used by SC UTs outside the exclusion areas.
- Spectrum in close proximity will be allocated for SC UTs outside a predefined distance from the ATC Base, but within the exclusion distance.
- Spectrum outside the above (near to band edge) will be used by SC UTs that are close to the ATC base, but outside the ATC cell coverage area.



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# Summary of Interference Analysis

- ATC Base station transmitting in Satellite downlink Spectrum
  - Additional Out of Band attenuation of 54 dB (relative to current specification of -56.5 dBW/4kHz (ex-parte filing)) from the ICO ATC base station is sufficient to enable MSS terminals to operate without loss very near an ATC base stations
- ATC UT transmitting in the Satellite downlink spectrum
  - Additional Out of Band attenuation of 36 dB (relative to current specification of -93.5 dBW/4kHz (ex-parte filing)) from the ICO ATC UT is sufficient to enable MSS terminals to operate without loss very near an ATC UT.
- ATC base station transmitting in the satellite uplink spectrum
  - Interference margins greater than 14 dB
- ATC User Terminal Transmitting in the satellite uplink spectrum
  - Interference margins greater than 25 dB




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# ATC OOB attenuation breakdown

- ATC Base

| | |
|---|---|
| • Voice Activity Factor: | 2.2 dB |
| • Power Control Factor: | 4.7 dB |
| • Guard band Attenuation/MHz: | 14 dB |
| • Polarisation discrimination: | 3 dB |
| • Hardware Improvements: | 30.1 dB |
| Total: | 54 dB |

- ATC UT

| | |
|---|---|
| • Voice Activity Factor: | 2.2 dB |
| • Power Control Factor: | 4.7 dB |
| • Guard Band Attenuation/MHz: | 14 dB |
| • Polarisation discrimination: | 3 dB |
| • Hardware improvements: | 12.1 dB |
| Total: | 36 dB |




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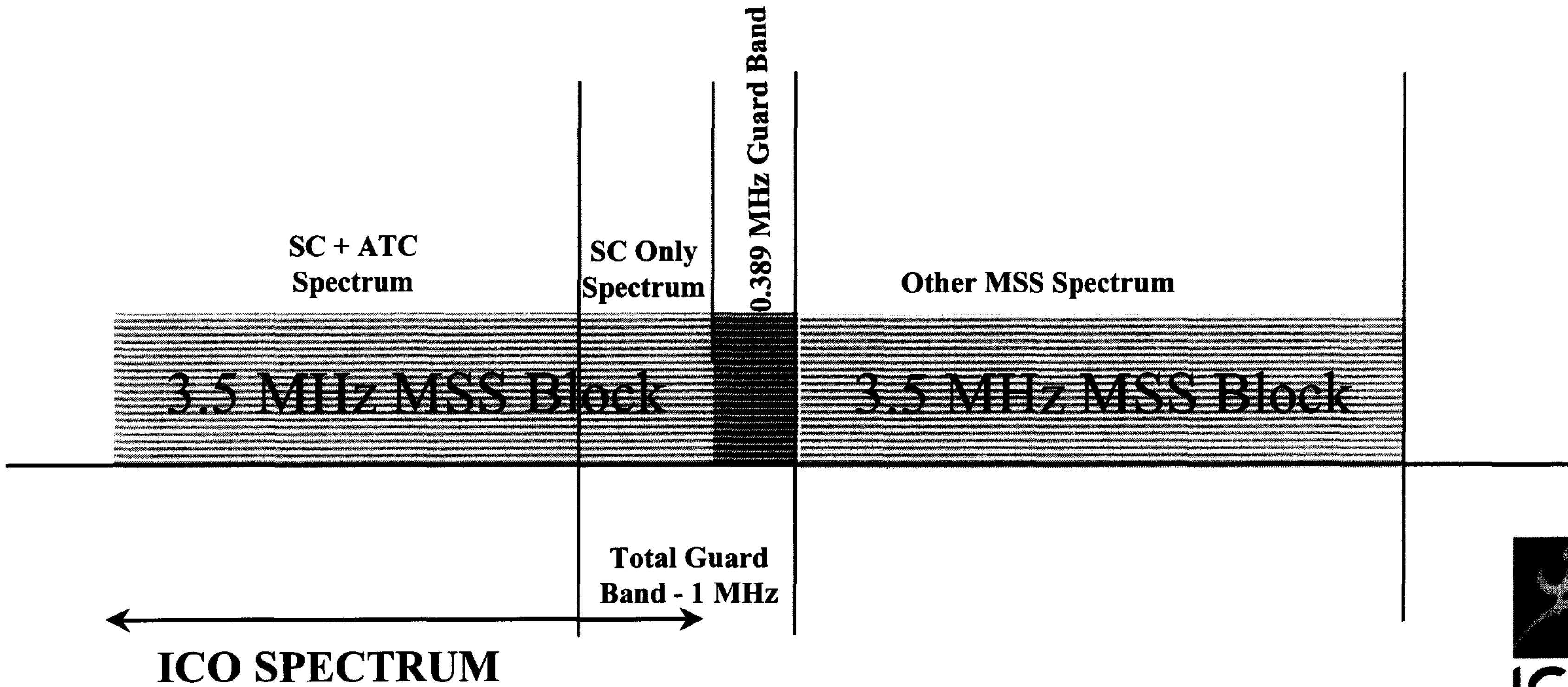
# Guard Band descriptions

- 9 Block allocations in 35 MHz spectrum provide 0.389 MHz guard bands between each block
- ICO limits ATC operation up to 0.611 MHz from block edge, thus providing overall guard band of 1 MHz between ATC and other MSS
- Guard band remains the same for all sharing modes



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# Current OOB emission limits

**Current emission limits for ATC**

| Out-of-Channel EIRP | UT | Base Station |
|---|---|---|
| 700 – 750 kHz offset from center | -53.3 dBW/4-kHz | -16.3 dBW/4-kHz |
| >750 kHz offset from center | -93.5 dBW/4-kHz | -56.5 dBW/4-kHz |

- New Proposed Specification, to be provided by ICO, will refer to emissions in **adjacent frequency blocks actually utilized by other MSS systems** rather than emissions at specified offsets from the center of the ATC channel.

 

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# Preliminary Proposed OOB emission limits (to be updated) (1 of 2)

- For MSS UTs
  - operating in ATC mode and transmitting in MSS downlink frequency band, out of band emission power in any 4 kHz band, measured within an utilized adjacent MSS downlink frequency block shall be $\leq$ -119.6 dBW (to be verified and updated).
  - operating in ATC mode and transmitting in MSS uplink frequency band, the out of band emission limits contained in FCC § 24.238 are appropriate.
  - operating in SC mode and transmitting in the MSS uplink band, the limits contained in FCC §25.202 (f) remain applicable.
- For a non-MSS terrestrial UT
  - emissions in any 4 kHz band, measured in the downlink MSS frequency band shall be $\leq$ -126.5 dBW (to be verified and updated).
  - emissions when measured in the MSS uplink frequency band shall be as per limits contained in FCC § 24.238.




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# Preliminary Proposed OOB emission limits (to be updated) (2 of 2)

- For ATC Base Stations
  - transmitting in the MSS downlink frequency band, out of band emissions in any 4 kHz band, measured within an utilized adjacent MSS downlink frequency block shall be ≤ -100.5 dBW (to be verified and updated)
  - transmitting in the MSS uplink frequency band, out of band emissions in the MSS uplink frequency band shall be as per limits contained in FCC § 24.238.
- For any fixed terrestrial transmitter
  - the emissions in any 4 kHz band, measured in the downlink MSS frequency band shall be ≤ -107.4 dBW (to be verified and updated)
  - emissions in the MSS uplink frequency band shall be as per limits contained in FCC § 24.238.
- Note:
  - Proposed emissions for MSS UTs and ATC base stations exclude additional improvements achieved by power control, voice activation and polarisation discrimination.
  - Proposed emissions for terrestrial UTs and base stations assume no power co and voice activation
  - All the emission power levels are computed at the antenna output.



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# Proposed limits for other sharing modes

- The proposed limits include all the sharing modes proposed by ICO, by inclusion of emission limits for ATC bases and ATC UTs transmitting in satellite downlink and uplink spectrum.



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